

SHOCK METAMORPHISM OF IMPACTITE LITHOLOGIES OF THE ICDP CHICXULUB DRILL CORE YAX-1. R. T. Schmitt, D. Stöffler and A. Wittmann, Institute of Mineralogy, Museum of Natural History, Humboldt-University of Berlin, Invalidenstr. 43, D-10115 Berlin, Germany (ralf-thomas.schmitt@rz.hu-berlin.de)

Introduction. The ICDP Chicxulub drillcore YAX-1 exposes about 100 m of allochthonous polymict impact breccias in a depth of 794.63 to 894.94 m [1]. In this preliminary study we focus on the shock effects and shock metamorphism of these impactites.

Methods. 26 thin sections of the impactites from Yax-1 have been investigated for shock effects by optical microscopy and REM. The shock classification of the components using the method described in [2].

Results. The description of the shock effects follows the profile through the impactites given by [1].

(1) Upper sorted suevite (794.63 – 807.75 m) and (2) Lower sorted suevite (807.75 – 823.25 m): The dominating component in both units of the sorted suevite are melt particles of shock stage IV. Two different textural types of melt particles were observed: (1) brownish to pale green silicate melt particles with flow texture, vesicles and schlieren; and (2) dark aphanitic particles with inclusions of mostly shocked and recrystallized silicate clasts and polycrystalline calcite which may indicate possible exsolution of a carbonate melt (Fig. 1). Both types of melt particles are completely crystallized. Outside of the melt particles polycrystalline quartz fragments (shocked and recrystallized) were observed, which may indicate higher shock pressures of shock stage II and III. Quartz and feldspar grains of shock stage I (Fig. 2) with decorated planar deformation features (PDF's) are present but rare.

(3) Upper suevite (823.25 – 846.09 m): Similar to the sorted suevite melt particles of shock stage IV are the dominating component. Two types of melt particles occur: (1) Large brownish silicate melt particles with flow texture, vesicles and schlieren and many inclusions of polycrystalline calcite in spherical to droplet-like and dike-like shapes (possible exsolutions of carbonate melt). These melt particles contain occasionally clasts of mostly shocked tectosilicates with PDF's or polycrystalline tectosilicates (shocked and recrystallized). Checkerboard plagioclase and ballen quartz (Fig. 3) occur also as inclusions. (2) Smaller shard-like transparent melt particles with concave-convex shapes due to large broken-up vesicles. Both types of melt particles are completely crystallized. Unaltered silicate components of shock stage II and III have not been observed yet.

(4) Middle Suevite (846.09 – 861.06 m): Melt particles (shock stage IV) are again the dominating component; at least two textural types of melt particles exist: (1) Large gray silicate melt particles with flow texture, vesicles and schlieren. Polycrystalline calcite inclusions are present in spherical to droplet-like and dike-like shapes (possible exsolutions of carbonate melt). These melt particles contain clasts of mostly shock stage I (shocked quartz and plagioclase with PDF's, the PDF's in quartz are "decorated") and polycrystalline tectosilicates (shocked and recrystallized) indicating higher shock stages. (2) Smaller brownish to yellowish melt particles with variable crystallization textures (fibrous, spherulitic, mosaic-like). Both types of melt particles are completely crystallized. Recrystallized silicate components probably represent shock stage II and III material.

(5) Suevitic breccia with cataclastic melt rock (861.06 – 884.96 m): Melt particles (shock stage IV) are again the dominating component and most of them are derived from a single melt lithology which is often cataclastically brecciated. These melt particles appear transparent to light gray to light brown. Flow texture, vesicles and schlieren are not as conspicuous as in the overlying and underlying suevite units. Small inclusions of clasts of shock stage I (shocked quartz with "decorated PDF's", Fig. 4), polycrystalline tectosilicates (shocked and recrystallized) and checkerboard plagioclase are present. Calcite is present in spherical to droplet-like and dike-like shapes (possible exsolution of carbonate melt). The smallest size fraction of melt particles in the matrix is rounded and could represent another type of melt. The melt particles are completely crystallized. Again, unaltered silicate components of shock stage II and III are lacking.

(6) Lower suevite (884.96 – 894.94 m): This unit consists of dominating large limestone agglomerates and a few crystalline rocks mixed with polymict breccias. Only samples from the polymict breccias were analyzed for shock features yet. Within the polymict breccias silicate melt particles of shock stage IV are the dominating component and display flow texture, vesicles and schlieren. These melt particles contain clasts of shock stage I (shocked quartz with "decorated PDF's") and polycrystalline tectosilicates (shocked and recrystallized) indicating higher shock stages (e.g., shock stages II and III). Inclusions of polycrystalline calcite are extremely rare and possible exsolution of

carbonate melt may be missing in contrast to the other units. All melt particles are completely crystallized. Silicate components of shock stage II and III are lacking within the polymict breccias and must have been completely recrystallized.

Discussion. Within all impactite units (794.63 - 894.94 m) the same features within silicate fragments could be observed: (1) Fragments of shock stage I display decorated PDF's. (2) Unaltered fragments of shock stages II (diaplectic glass) and III (normal mineral glass) are lacking since they have been completely recrystallized. (3) Melt fragments of shock stage IV are crystallized, indicate in many cases a possible exsolution of carbonate melts and contain shocked and recrystallized crystalline fragments. In comparison to suevite deposits of smaller impact craters (e.g. Nördlinger Ries [3,4]) the content of melt fragments within the Chicxulub suevites is much higher. The intense (re)crystallization of fragments and melt fragments indicate very high post-depositional temperatures and a strong post impact hydrothermal activity which are typical for melt-rich impactite units [5].

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References: [1] Stöffler D. et al. (2003) *LPS*, this volume. [2] Stöffler D. (1971) *JGR*, 76, 5541-5551. [3] Stöffler et al. (1977) *Geologica Bavarica*, 77, 163-189. [4] Engelhardt v. W. (1997) *MAPS*, 32, 545-554. [5] Grieve R. F. A. et al. (1996) *MAPS*, 31, 6-35.

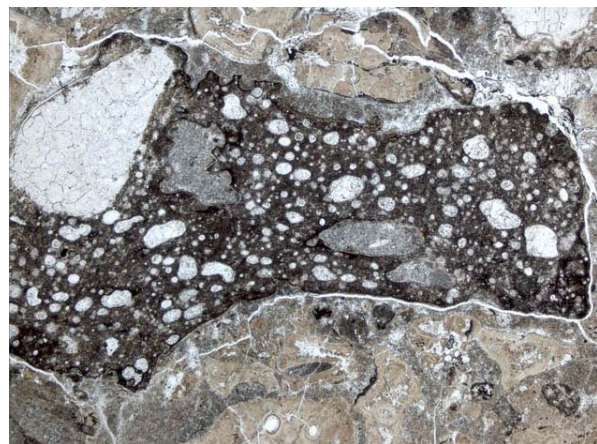


Fig. 1: Silicate melt particle (type 2) with droplet-like inclusions of calcite, which may indicate an exsolution of a carbonate melt, and on the upper left hand side a typical polycrystalline ballen quartz aggregate. Sample Yax-1_808,87 m, thin section, plane polarized light, width 4,5 mm.

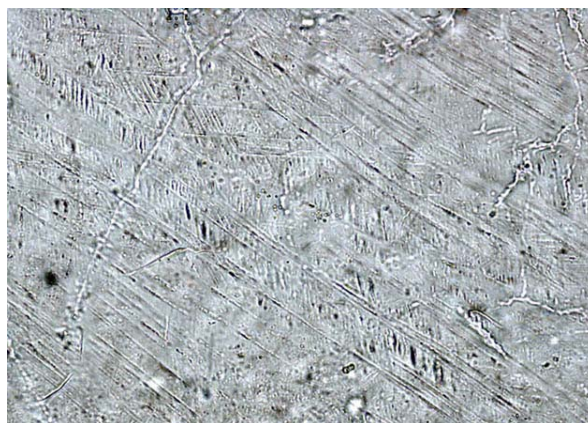


Fig. 2: Potassium feldspar with planar deformation features, sample Yax-1_808,87 m, thin section, plane polarized light, width 200 µm.

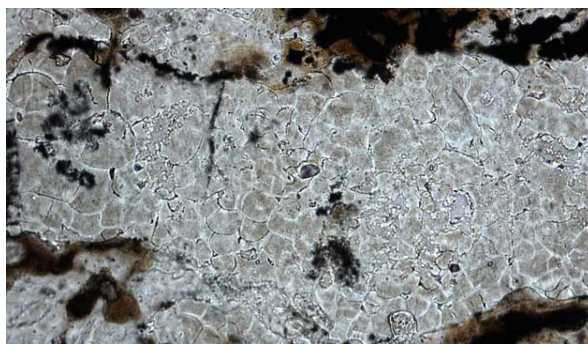


Fig. 3: Polycrystalline aggregate of ballen quartz, sample Yax-1_825,80 m, thin section, plane polarized light, width 570 µm.

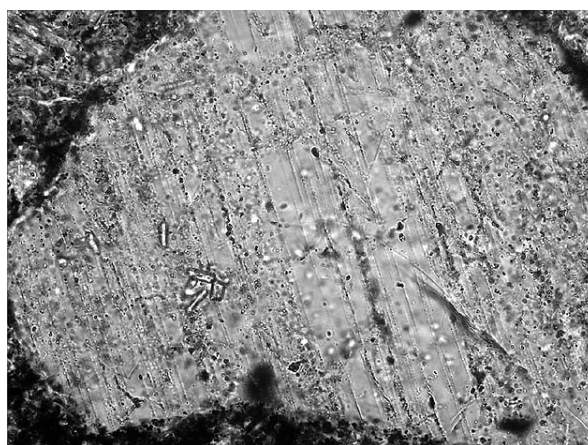


Fig. 4: Quartz grain with decorated planar deformation features from a melt particle, sample Yax-1_865,01 m, thin section, plane polarized light, width 260 µm